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•DISCOVER THE GIANTS OF THE PREHISTORIC WORLD•

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PINACOSAURUS

With one hefty blow of its tail-club, *Pinacosaurus* could cripple the most bloodthirsty predators.

From its bony skull to the tip of its tail-club, *Pinacosaurus* had almost complete protection from enemies. Like other ankylosaurids, its back was covered with a shield of bony spines. *Pinacosaurus* was as long as a Nile crocodile and moved nimbly on four legs.

CRASH HELMET

Pinacosaurus had a very strong skull, harder than a crash helmet. When a human is born, its skull bones have small gaps between them. The bones move closer together as the baby grows. Experts studying the skull of a young *Pinacosaurus* found that the plates of bone in its skull also had gaps between them. These fused together to make a surface of bone as the dinosaur grew.

EASY BREATHER

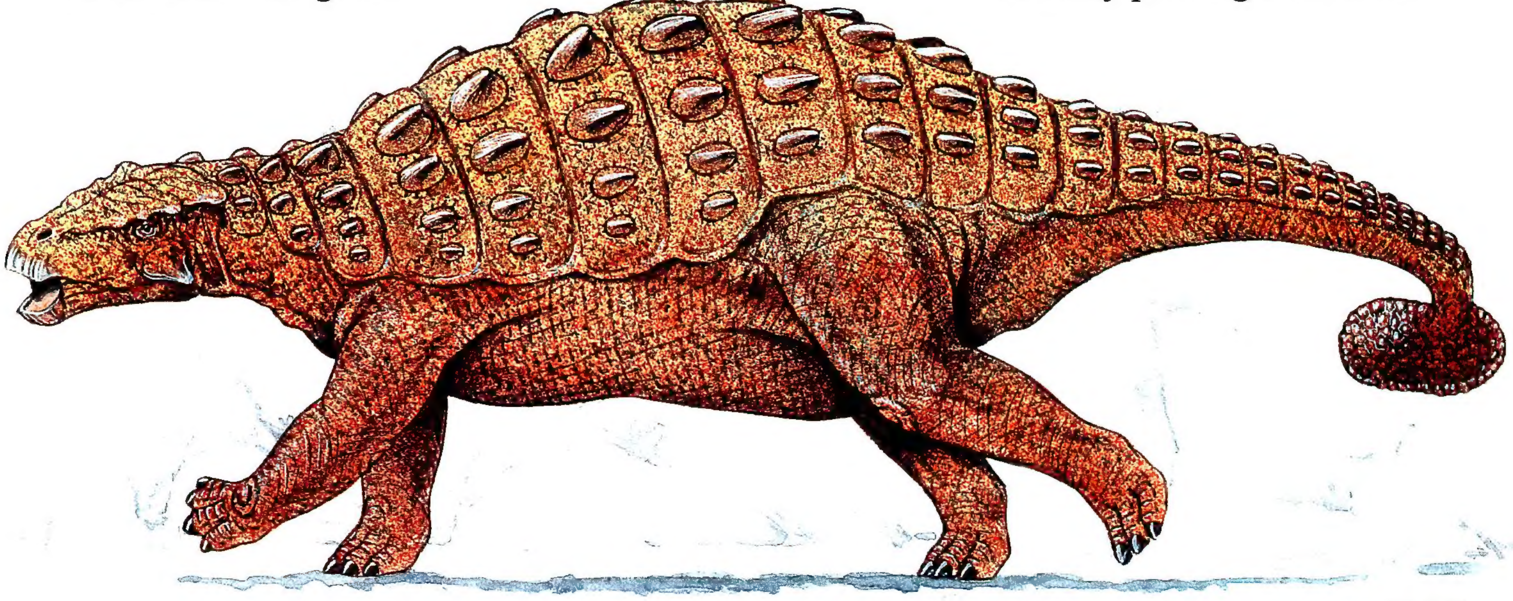
Inside *Pinacosaurus*' nose there were lots of thin, curved bones which made a sort of S-shape. These nasal passages were covered in membranes. They probably helped *Pinacosaurus* to breathe better by warming, filtering and moistening the air as it travelled through the tubes.

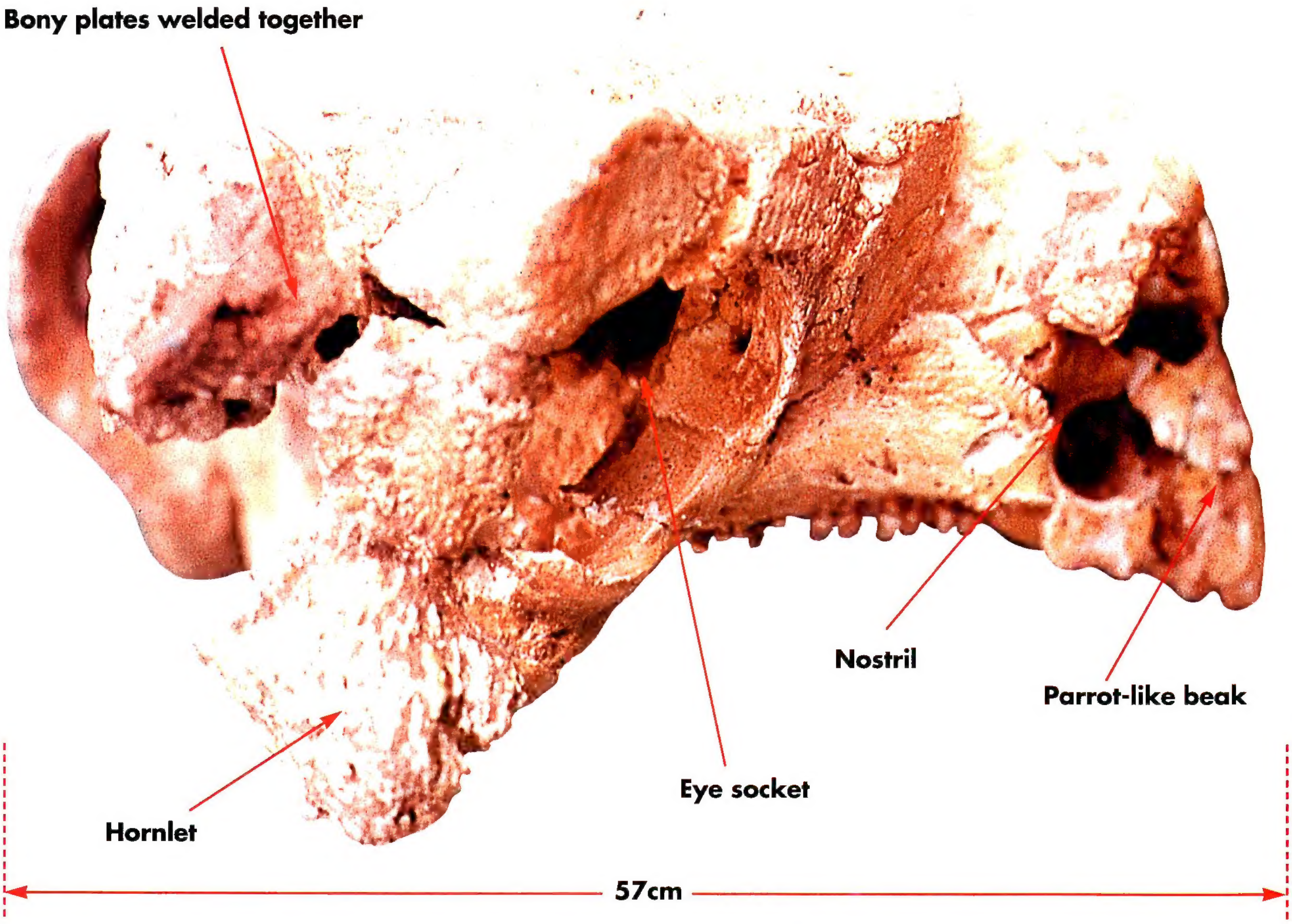
DEADLY WEAPON

Huge two-legged tyrannosaurids were no match for tough *Pinacosaurus*. Although much smaller, the armoured dinosaur had a deadly weapon. A sideways blow with its heavy tail-club could easily bring an attacker crashing to the ground.

ENEMIES FLATTENED

If the predator's leg or hip bones were broken there was no way it could get up again. As *Pinacosaurus* wandered off after the fight its enemy lay on the ground, helpless, completely at the mercy of every passing carnivore.



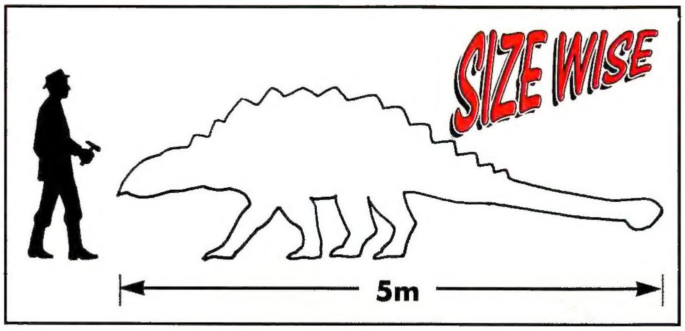


SUPER SWINGER

The tail-club was made from chunks of bone fused together. It was as hard and heavy as a boulder of rock. *Pinacosaurus* needed strong tail muscles to lift the club from the ground and swing it from side to side. Long, powerful muscles stretched down from the dinosaur's hips and legs to support the tail and make it flexible.

QUICK FLIP

Pinacosaurus had such super defences that only the hungriest predators bothered to attack it. Experts think that the only way to beat an ankylosaur was to tip it right over on to its back and bite into its unprotected belly. But the carnivore's problem was how to get close enough to *Pinacosaurus* to do it!



MONSTER FACTS

- **NAME:** *Pinacosaurus* (pin-ak-oh-saw-rus) means 'plank reptile'
- **SIZE:** up to 5m long
- **FOOD:** soft, low-growing plants
- **LIVED:** about 80 million years ago in the Late Cretaceous Period in Mongolia and parts of northern China.

Is it true that only four footed plant-eaters used their tails for defence?

Yes. Dinosaurs like *Diplodocus* and *Stegosaurus* walked on four legs, which left their tails free. When an enemy attacked, some plant-eaters used their tails like whips. Others had spikes or bony clubs with which to defend themselves. Two legged plant-eaters such as the duckbills needed their tails for balance. They relied on speed to make their escape.

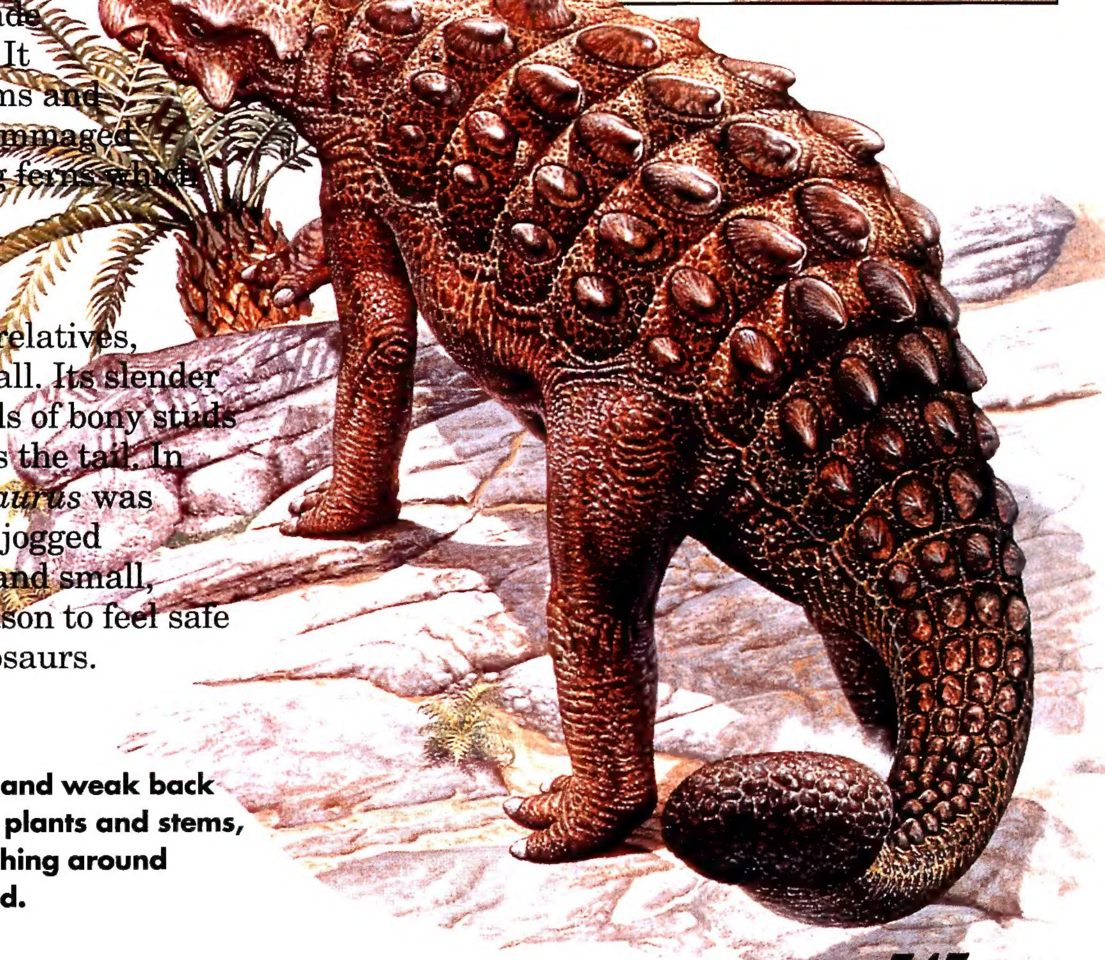
The medieval knight on the right is holding a mace. He used it as a weapon in battle, in much the same way as *Pinacosaurus* used its tail-club.

FUSSY EATER

Pinacosaurus had a short, squat skull which curved down into a parrot-like toothless beak. Further back it had rows of small, weak teeth which made *Pinacosaurus* a fussy eater. It probably avoided tough stems and pine needles and instead rummaged around for soft, low-growing ferns which were easier to chew.

WELL PROTECTED

Compared with some of its relatives, *Pinacosaurus* was quite small. Its slender body was covered with bands of bony studs which grew smaller towards the tail. In spite of its armour, *Pinacosaurus* was quite agile for its size. As it jogged around on four sturdy legs and small, dainty feet, it had every reason to feel safe from even the fiercest carnosaurs.



***Pinacosaurus'* parrot-like beak and weak back teeth could not deal with tough plants and stems, so it spent most of its day searching around for the softest plants it could find.**

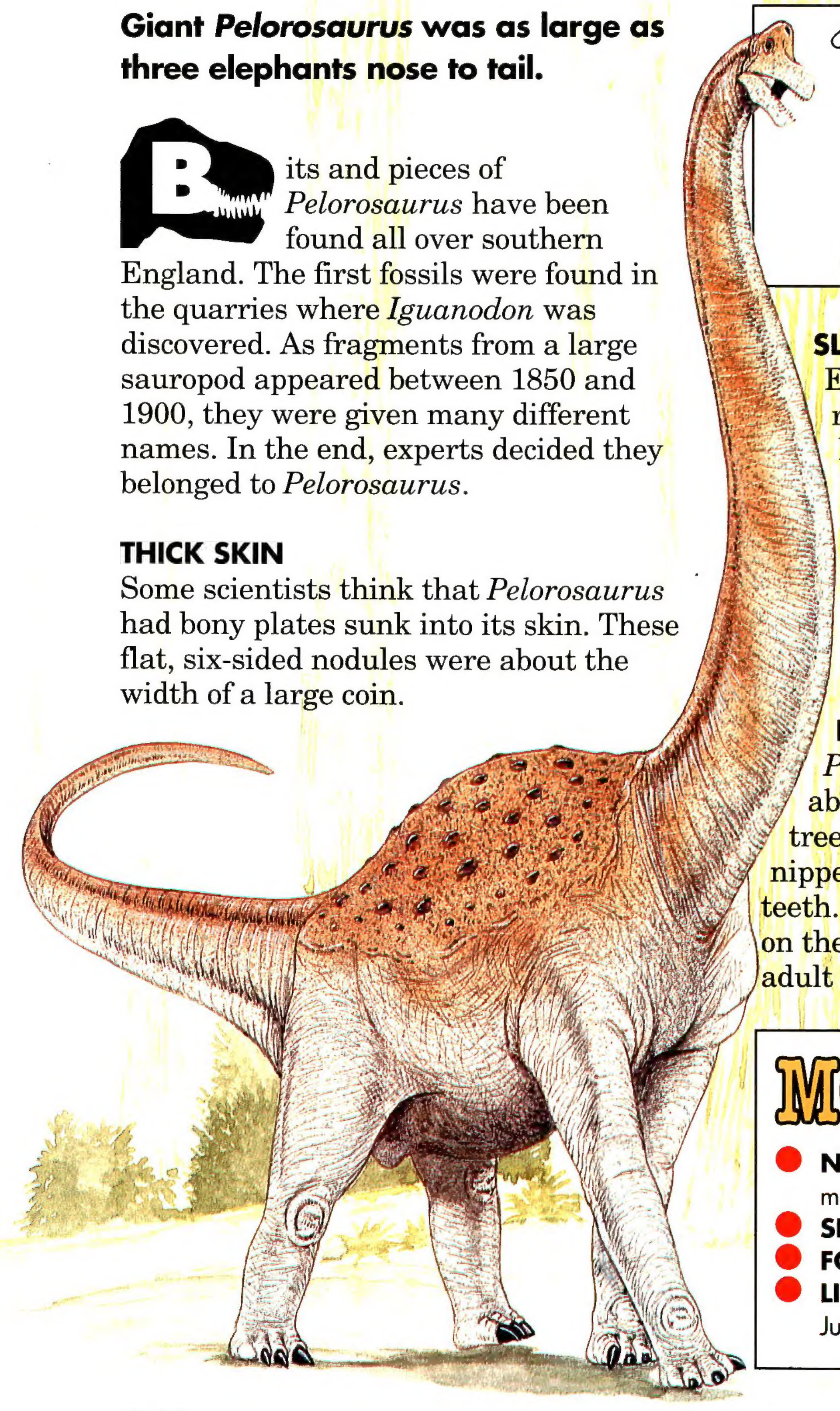
PELOROSAURUS

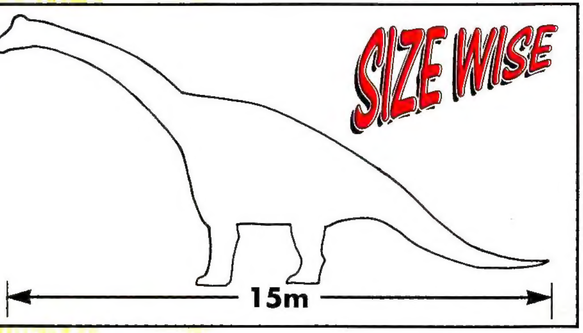
Giant *Pelorosaurus* was as large as three elephants nose to tail.

Bits and pieces of *Pelorosaurus* have been found all over southern England. The first fossils were found in the quarries where *Iguanodon* was discovered. As fragments from a large sauropod appeared between 1850 and 1900, they were given many different names. In the end, experts decided they belonged to *Pelorosaurus*.

THICK SKIN

Some scientists think that *Pelorosaurus* had bony plates sunk into its skin. These flat, six-sided nodules were about the width of a large coin.





SLOPING BODY

Experts think that *Pelorosaurus* was related to *Brachiosaurus* and had a long slender neck like a giraffe. Its body sloped downwards from its shoulders to its hips, and ended in a long, tapering tail. *Pelorosaurus* stood on four huge legs and had thick, padded feet, quite unlike the long, lanky limbs of today's giraffe.

HIGH BROWSER

Pelorosaurus was so tall that it was able to reach the tops of the tallest trees. It browsed among the trees and nipped off leaves with its chisel-like teeth. One of its teeth, which was found on the Isle of Wight, is longer than an adult human's finger.

MONSTER FACTS

- **NAME:** *Pelorosaurus* (pel-o-roe-saw-rus) means 'monster reptile'
- **SIZE:** up to 15m
- **FOOD:** plants
- **LIVED:** about 145 million years ago in the Late Jurassic Period in Sussex, southern England.

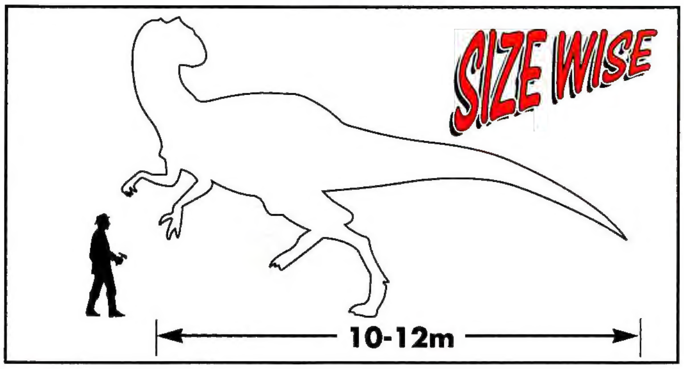
CHILANTAISAURUS

Chilantaisaurus was a meat-eating dinosaur with huge claws and enormous jaws.

Very little is known about this big carnosaur as only a few bones from its skull, arms and a leg have been found. *Chilantaisaurus* was a fierce predator, probably about the same length and weight as three cars. It ran on two powerful legs with great agility and may have hunted in packs.

MONSTER FACTS

- **NAME:** *Chilantaisaurus* (key-lan-tay-saw-rus) means 'Ch'i-lan-t'ai reptile'.
- **SIZE:** probably 10-12m long
- **FOOD:** meat, especially other dinosaurs
- **LIVED:** about 140 million years ago in north-west and southern China

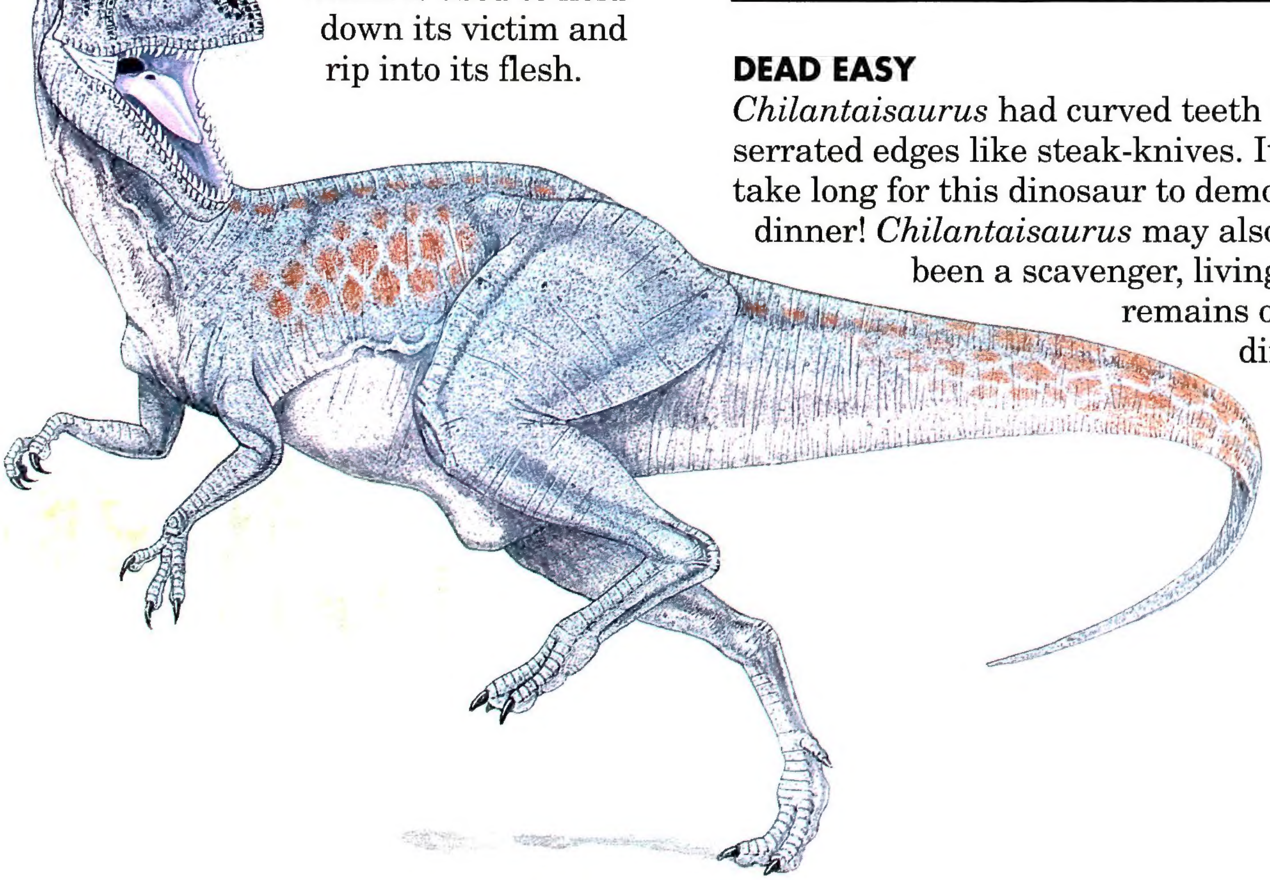


BIG CLAWS

As it pounded along in pursuit of its prey, *Chilantaisaurus* was an awe-inspiring sight. At the end of its arms were long, curved claws which it used to hold down its victim and rip into its flesh.

DEAD EASY

Chilantaisaurus had curved teeth with serrated edges like steak-knives. It did not take long for this dinosaur to demolish its dinner! *Chilantaisaurus* may also have been a scavenger, living off the remains of dead dinosaurs.



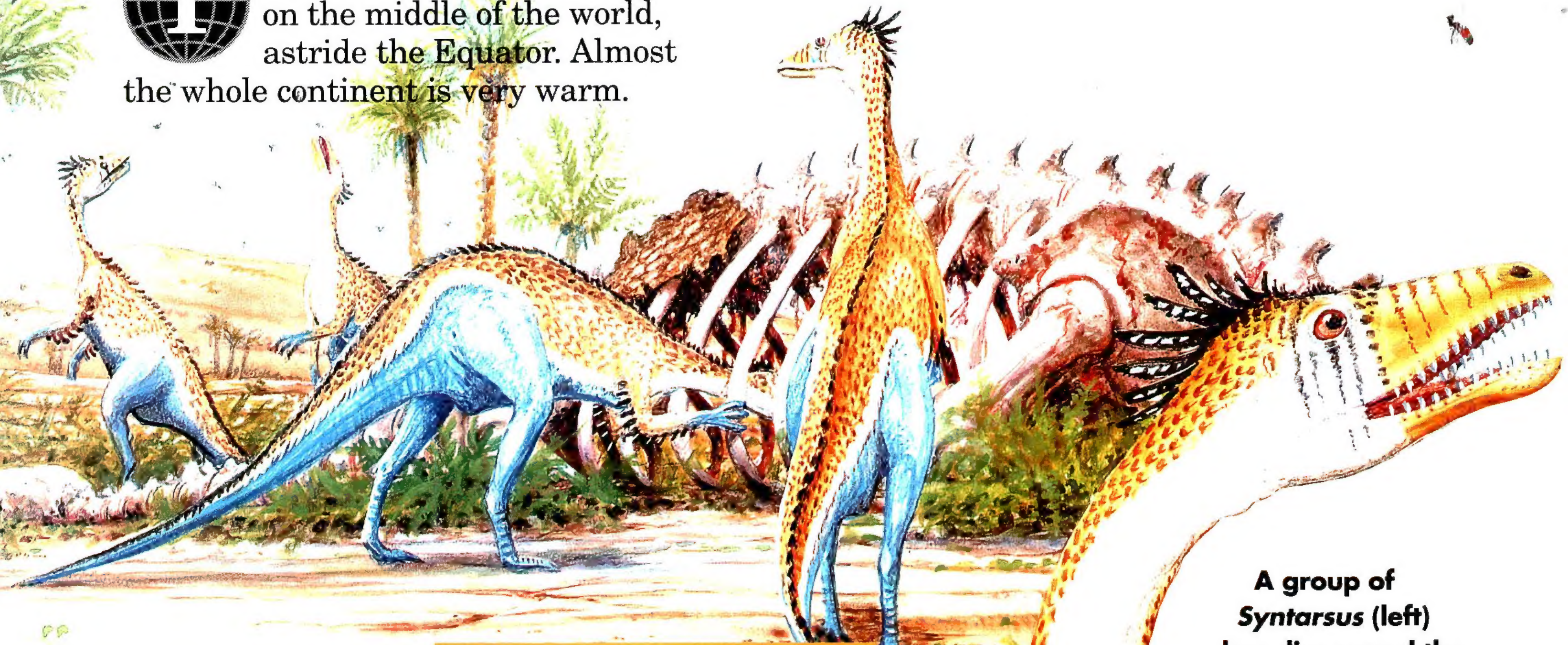
Dinosaurs from Africa

During the Age of the Dinosaurs, Africa was home to some of the oldest and largest known dinosaurs.

The vast land mass of Africa sits on the middle of the world, astride the Equator. Almost the whole continent is very warm.

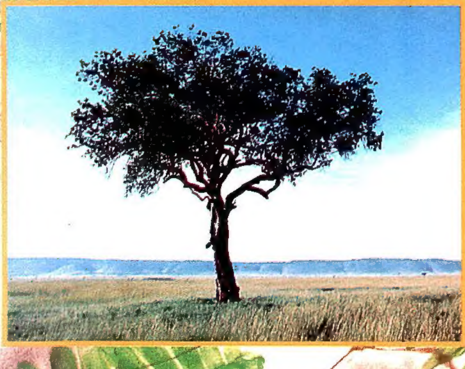
ALL SORTS OF WEATHER

Today the climate varies from dust dry in the Sahara Desert in the north, to soaking wet in the tropical rainforests of the west and centre, to fairly dry on the grasslands in the east and the south.

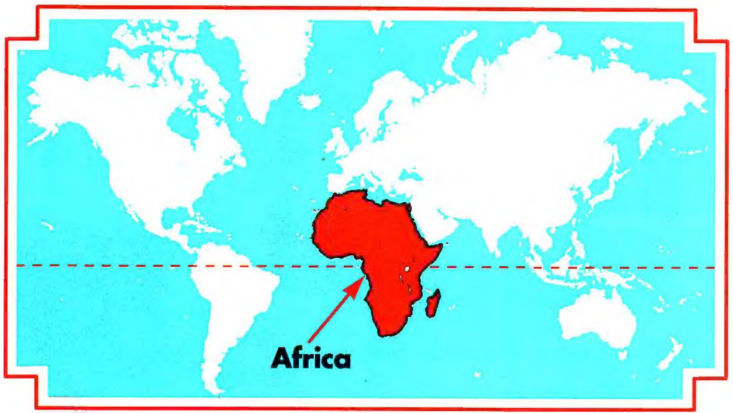


A group of *Syntarsus* (left) has discovered the abandoned carcass of a large dinosaur.

Today's African landscapes include dry deserts with very little vegetation (right).



Wide expanses of grassland (left) cover the plains of eastern and southern Africa.



WARM AND DRY

During the Age of the Dinosaurs, Africa was near the centre of the huge land mass called Pangaea, where it was warm and dry. As Pangaea broke up Africa stayed hot and dry. This climate was ideal for dinosaurs, and many different kinds lived successfully in this huge area.

SPEEDY SOUTHERNER

Fossils show that some of the very first dinosaurs lived in southern Africa about 200 million years ago. A small, speedy dinosaur called *Syntarsus* was one of them. *Syntarsus* was about as long as a small car with a wedge-shaped head, and a long neck and tail.

INSECT SNAPPER

Syntarsus' long arms ended in hands with curved claws that were useful for gripping small, wriggling prey. It chased after fast-moving food such as flying insects, small mammals and lizards. It probably also fed on the carcasses of larger animals that had been killed by other dinosaurs and left after they had eaten their fill.

ONE-METRE PLANT-EATER

A small plant-eater called *Fabrosaurus* was another early African dinosaur. *Fabrosaurus* was about 1m tall and had teeth at the front of its upper jaw, but none at the front of its lower jaw. It probably had a large stomach for digesting plants.

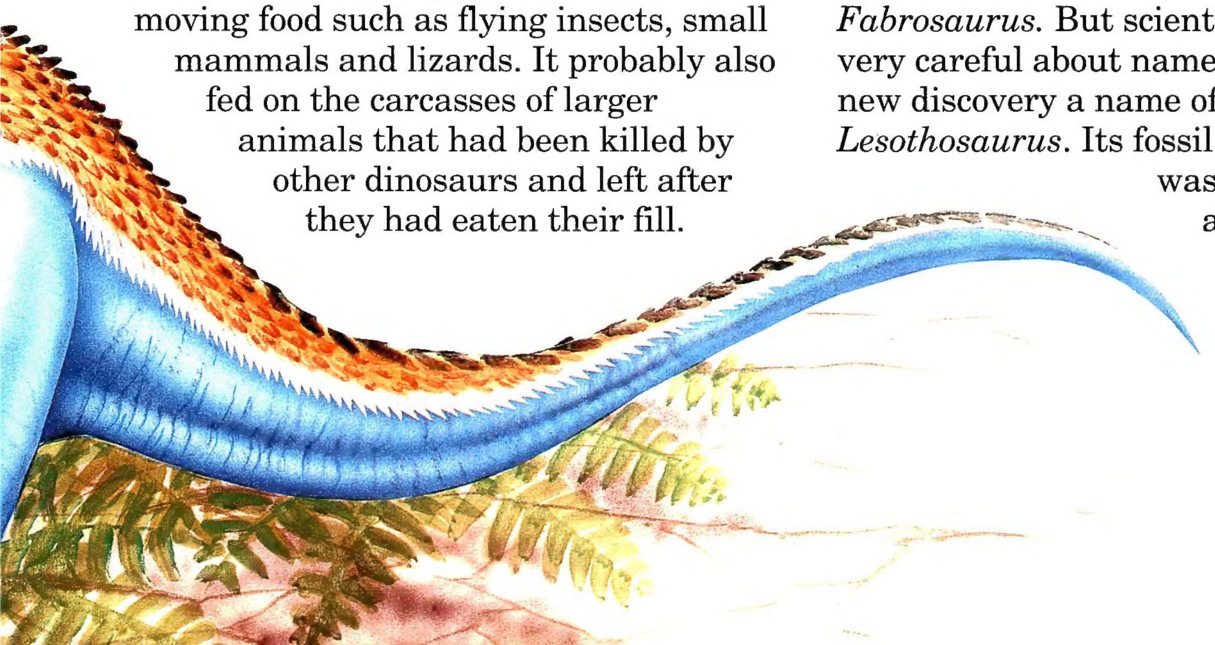
IT'S A FACT

EXPERTS DON'T ALWAYS AGREE

Piecing together the jigsaw of the past is very difficult. Facts are often not clear and experts may, for example, differ in their opinions about what a dinosaur looked like. Some experts think *Syntarsus* may have had feathers, others disagree. Until new evidence is found, no one knows for certain.

SMALL AND SLIM

At first, the *Fabrosaurus* fossils were so scarce, that no one was sure what the animal looked like. More clues came in the 1970s, when parts of a dinosaur skeleton were found in Lesotho in southern Africa. This animal had almost identical teeth to *Fabrosaurus*. But scientists have to be very careful about names, so they gave the new discovery a name of its own, *Lesothosaurus*. Its fossil showed that it was small and slim and little bigger than a chicken. It could run fast on two legs, and was a plant-eater.



AFRICAN ANCESTORS

Another very early group of dinosaurs that lived in Africa, in the Late Triassic Period, was the prosauropods. These dinosaurs were relatives of the giant sauropods, such as *Brachiosaurus* and *Diplodocus*. One well-known prosauropod was *Anchisaurus*.

AFRICAN-AMERICAN

Anchisaurus fossils were first found in North America. When they were found in Africa, they were called *Thecodontosaurus*. But they were so similar to the American ones that they were renamed *Anchisaurus*.

CARTOON DINO

Anchisaurus was a four-legged and low-slung dinosaur, about 2.5m long. It was the same size and shape as cartoon hero Fred Flintstone's pet dinosaur 'Dino'.

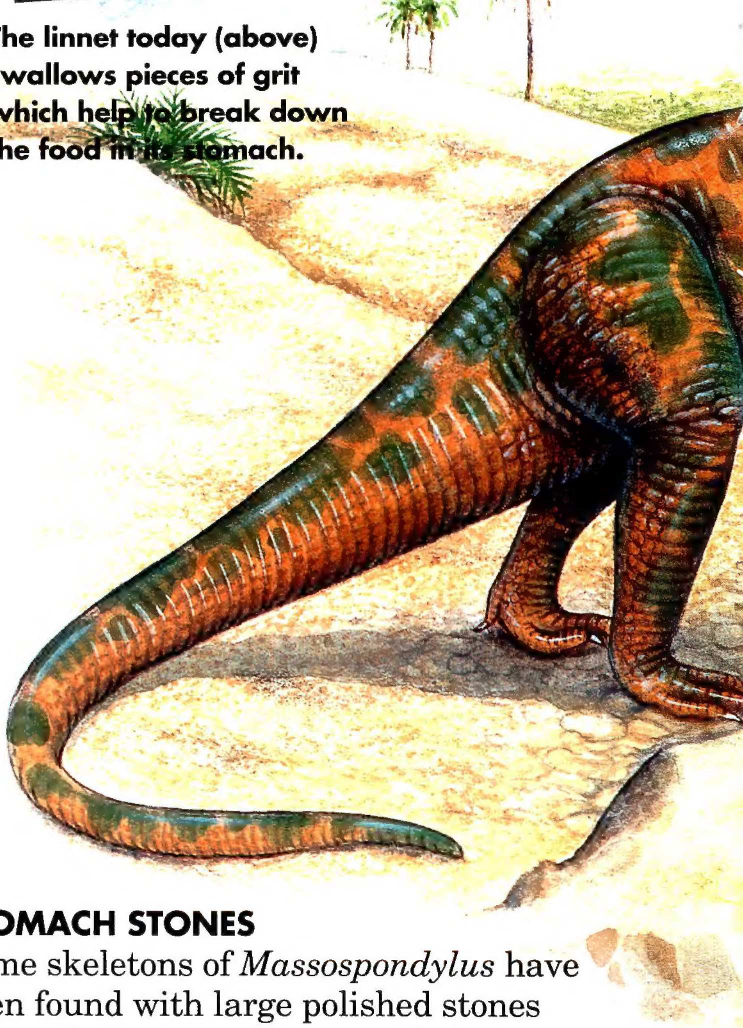
BIG BACKBONES

Just about the most common prosauropod in Africa was *Massospondylus*, 'massive vertebrae' (or big backbones). This dinosaur was 4m long. It had a long, flexible neck with a tiny head and many small teeth. It could have walked on all fours or reared up on its hind legs to grasp vegetation with its hands.

Is it true that some of today's animals also swallow stones?

Yes. Birds today have no teeth to chop and grind up tough plants and seeds. To help them digest their food many use stones just as the dinosaurs did. Birds swallow grit and very small stones. The grit rests in the part of a bird's gut called the gizzard. When the food passes through the gizzard, the grit and small stones churn around with the food and grind it down to a pulp which is much easier for birds to digest.

The linnet today (above) swallows pieces of grit which help to break down the food in its stomach.



STOMACH STONES

Some skeletons of *Massospondylus* have been found with large polished stones where their stomachs were. These are gastroliths, or stomach stones, and helped grind up the creature's plant food.

STEGOS TOO

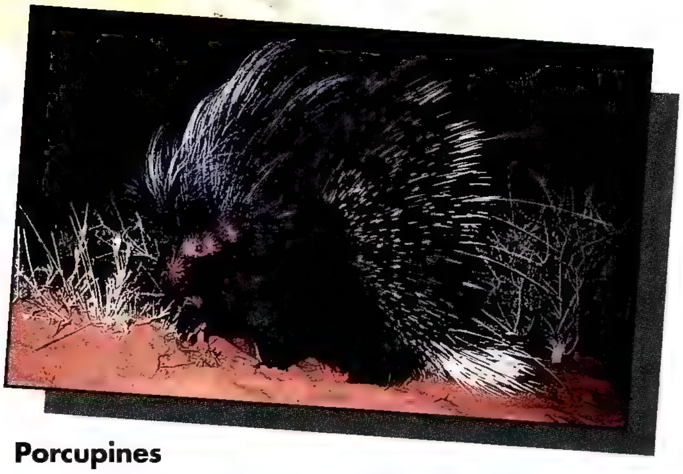
Africa also had its share of *Stegosaurus*-type dinosaurs. *Kentrosaurus* was one. *Kentrosaurus* was only 2.5m long, smaller than *Stegosaurus*. It had narrow, bony plates sticking up from the front part of its back, and long sharp spines on its sides and tail. It was like a dinosaur-porcupine.

Massospondylus **(below) stands beside a river in the Late Triassic swallowing the stones which help it to digest tough plants.**

LARGEST ON EARTH

Africa today is home to the largest land animals alive today. They are elephants, rhinos, hippos, and the tallest animal, the giraffe. Africa was also home to some of the largest dinosaurs ever to thunder over the earth. They included *Brachiosaurus,* which was twice as tall as a giraffe and heavier than 10 elephants.

The African elephant (above) is the largest land animal alive today.



Porcupines (above) use their spines in the same way as *Kentrosaurus* did millions of years ago.

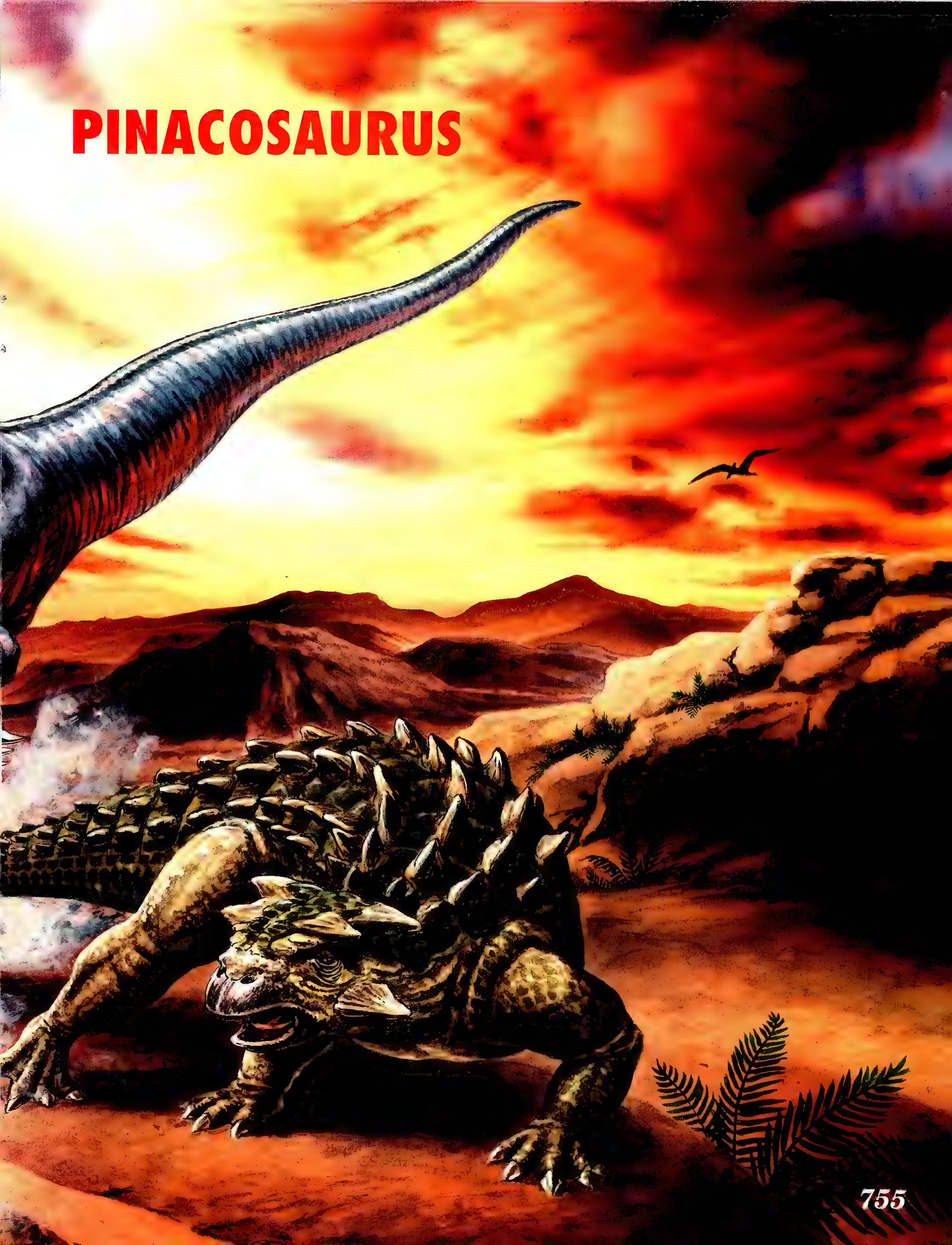
AFRICAN CARNIVORES

Meat-eating dinosaurs also thrived in Africa millions of years ago. Fossils of *Elaphrosaurus* were found in eastern Africa early this century, although the head is missing. It was slim and ran fast on two legs. *Spinosaurus* was a carnosaur-type dinosaur, with rows of fearsome teeth and a sail 2m tall on its back. It lived alongside the sail-backed *Ouranosaurus* in Niger 110 million years ago.

GIANTS OF THE PAST

Under a stormy [illegible] the [illegible] [illegible] Mongolia, two dinosaurs fight to the death. *Pinacosaurus* has just swung a mighty blow with its hefty club-tail at *Alectrosaurus'* leg. Badly wounded, the fierce meat-eater is about to crash to the ground, where it will soon be easy prey for any passing carnosaur.

PINACOSAURUS



3-D Gallery

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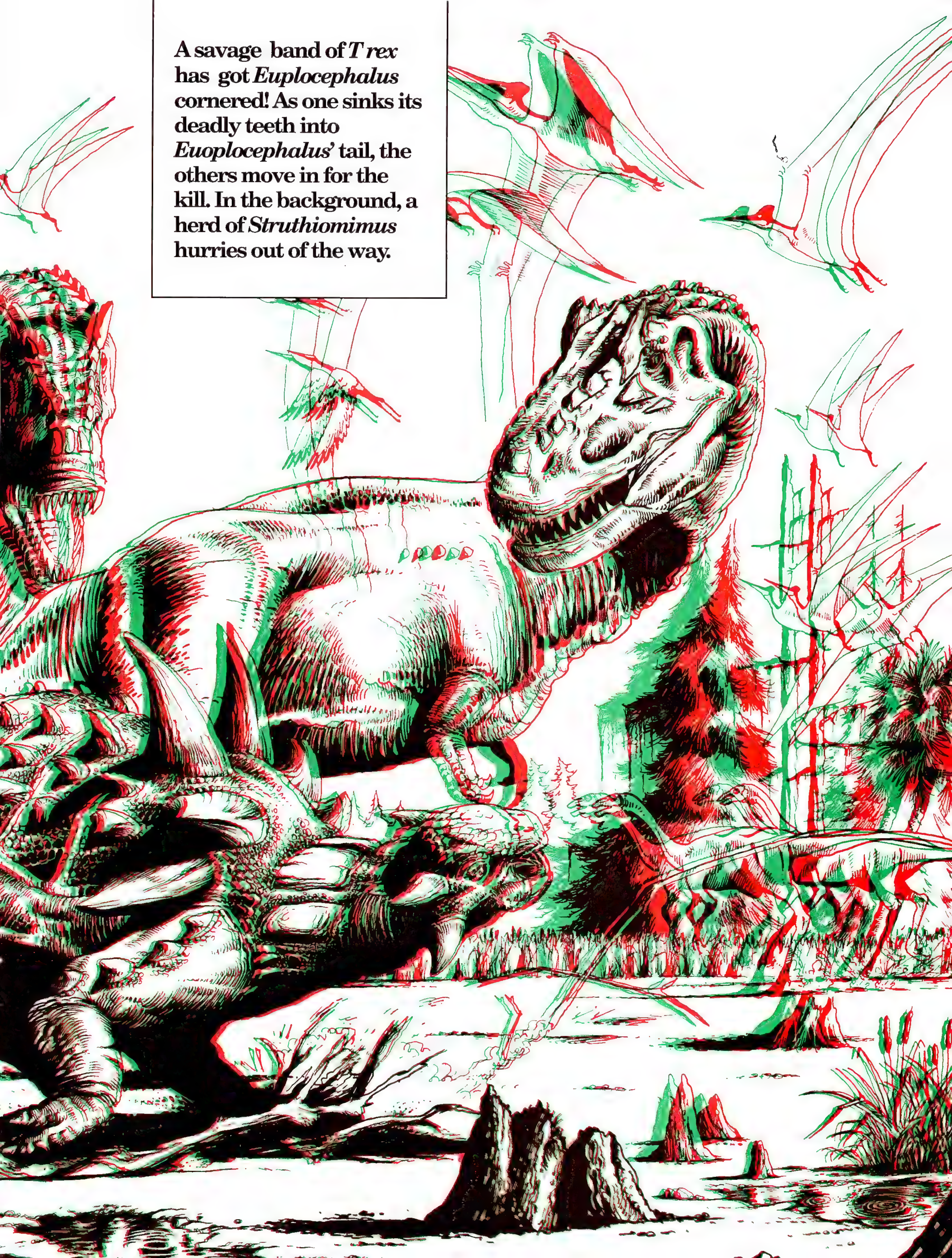
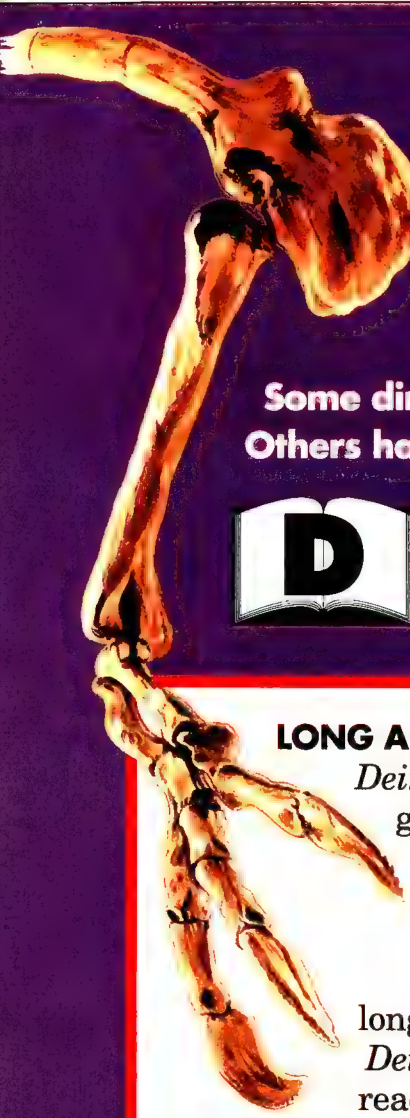
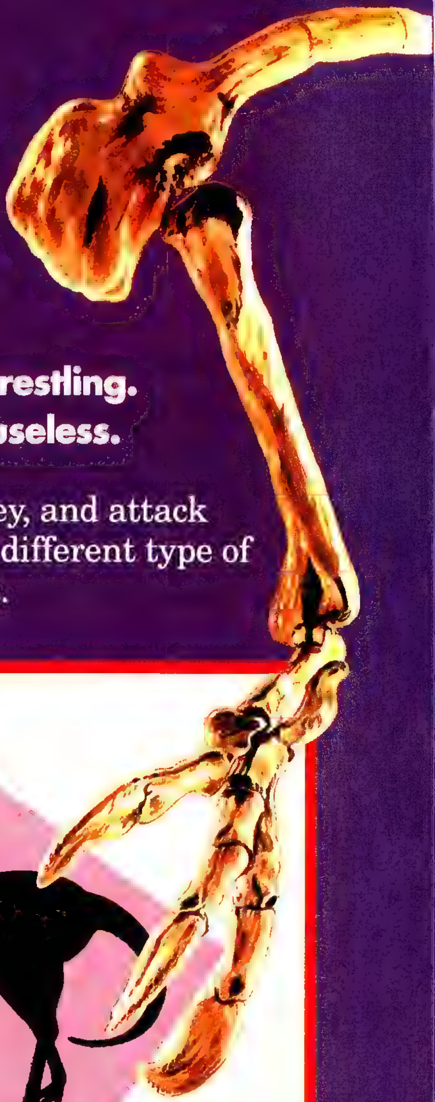
T REX v EUOPLOCEPHALUS

A savage band of *T rex* has got *Euplocephalus* cornered! As one sinks its deadly teeth into *Euoplocephalus'* tail, the others move in for the kill. In the background, a herd of *Struthiomimus* hurries out of the way.



ARMS



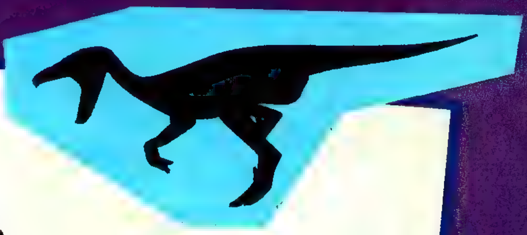


Some dinosaurs had strong arms that they used for wrestling. Others had tiny, feeble forelimbs that were practically useless.

Dinosaurs used their arms for reaching, holding prey, and attack and defence. Here are five dinosaurs, each with a different type of arm that they used in an amazing variety of ways.

LONG AND BLUNT *DEINOCHEIRUS*

Deinocheirus' arms were longer than a fully grown man. Experts think *Deinocheirus* (which means 'terrible hand') was an ostrich mimic dinosaur. It may have looked like a massive *Gallimimus,* another ostrich mimic which has quite long arms. Although its arms look lethal, *Deinocheirus* may only have used them for reaching the branches with the juiciest leaves. As well as plants, it ate small lizards and mammals, but its claws were much too blunt to tear flesh.



LASHING OUT *DEINONYCHUS*

Deinonychus was able to keep its prey at arm's length. On the end of its arms, the dinosaur had three claws that look like massive meat-hooks. Its arms were long enough to lash out, while keeping its victim at a safe distance. Tiny scars left on fossilized bones show that *Deinonychus* had very strong shoulders and arms. Once it had caught its prey it held it tightly with its arms while ripping it to shreds with the deadly claws on its feet.

SMALL, BUT TOUGH *HETERODONTOSAURUS*

Plant-eaters were not usually well-equipped to fight. But *Heterodontosaurus* was an exception. It developed strong arms so that it could grapple with attackers. Just as a cat today will swipe a dog across the nose, *Heterodontosaurus* used its arms to fight back. This dinosaur's arms were strong enough to be useful when a predator got too close.

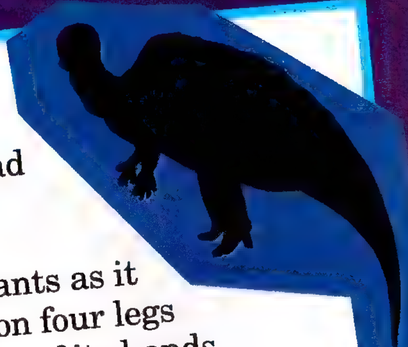
IT'S A FACT

ARMED WITH EVIDENCE

Most experts agree that dinosaurs evolved into birds over millions of years. Scientists look at dinosaurs' arms to try and work out how they developed into wings. Where *Deinonychus'* wrists joined its arms there is a moon-shaped bone. There is a very similar bone in the wing of *Archaeopteryx,* one of the earliest birds. Experts use these matching bones as proof that dinosaurs evolved into birds.

SHORT AND STUMPY *CARNOTAURUS*

One of the fiercest dinosaurs, *Carnotaurus* had a huge body, teeth for ripping flesh and strong legs. But it had short, stumpy arms. They were weaker than those of other large meat-eaters. *Carnotaurus* probably didn't use its arms much, choosing instead to hold down its prey with its clawed feet.

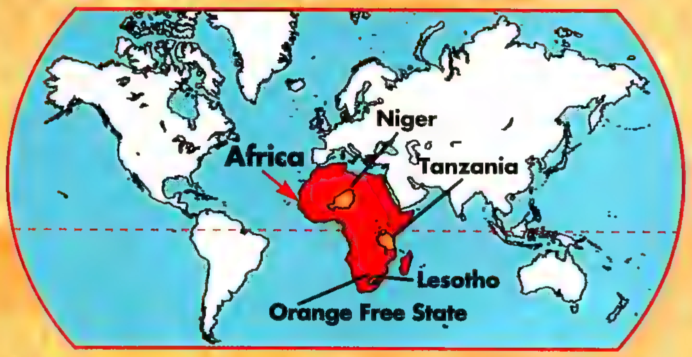


ON ALL FOURS *OURANOSAURUS*

If *Ouranosaurus* got tired of walking on its back legs, it tipped forward on to its arms and had a rest. Just like a kangaroo or a gorilla today, this dinosaur could also walk on all four limbs. This was particularly useful if it was browsing on low-lying plants as it walked along. We know that *Ouranosaurus* walked on four legs because instead of claws, it had small hoofs on the end of its hands. It propped the weight of the front of its body on these small, flat hoofs.

Expeditions: AFRICA

In 1907 a German engineer stumbled on a dinosaur graveyard in eastern Africa and started the biggest dinosaur dig ever.



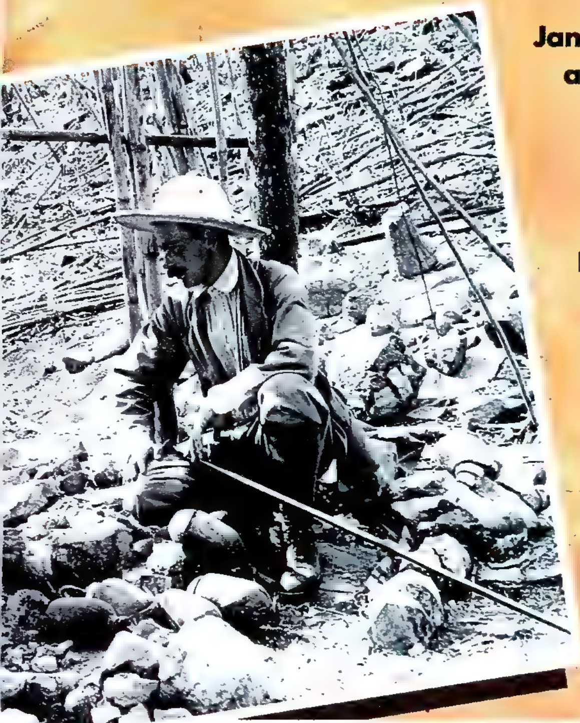
Werner Janensch was the young curator of fossil reptiles at the Berlin Museum in Germany which organised a series of expeditions to Africa from 1909 to 1912. Helped by German experts and hundreds of local people, he uncovered the richest dinosaur bone bed south of the Equator.

FROM GERMANY

Deep pits had to be dug by hand to reach the fossils, and 500 workers were needed to do it. Then the bones were packed into boxes and carried by porters for four days to the nearest port. More than 1000 boxes were shipped back to Germany. Janensch's prize find was the complete skeleton of a giant *Brachiosaurus*. It was the biggest dinosaur ever discovered. When it was rebuilt it was tall enough to look over the top of a four-storey building.

Carrying the dinosaur bones to the port of Lindi (left). The porters made 5,400 trips in three years.

The bare, scrubby landscape of the Serengetti Conservation Area in Tanzania today (right).

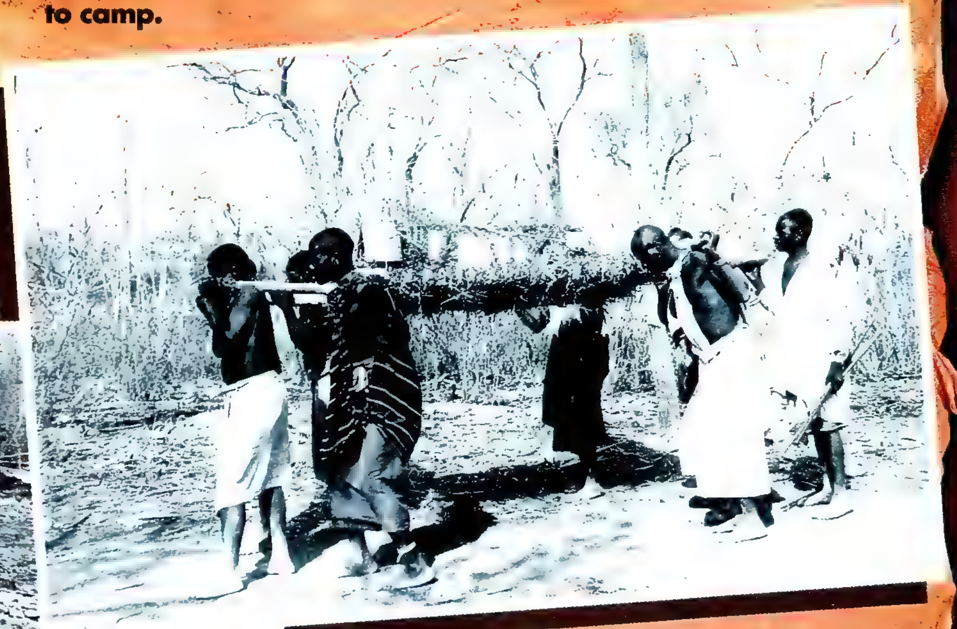


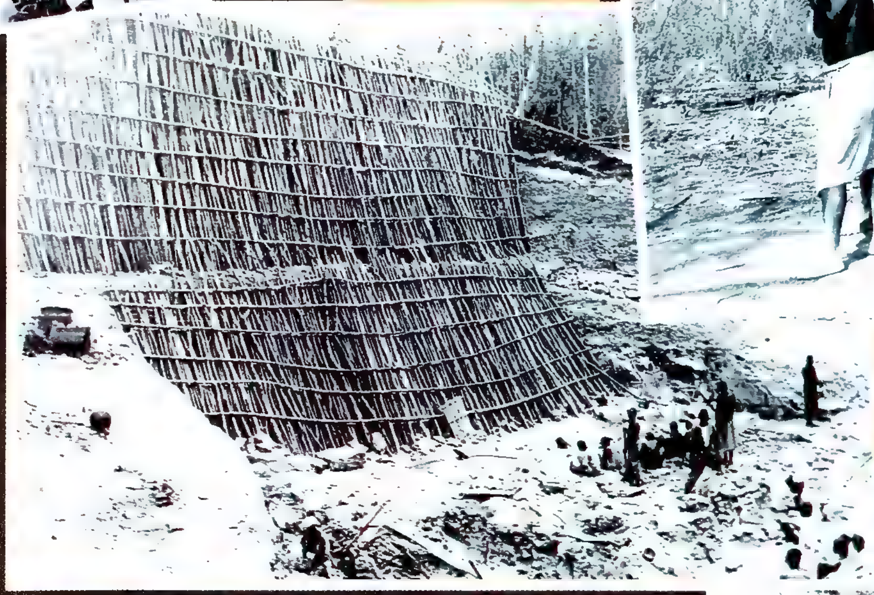
Left: Werner Janensch (on right) and his assistant Salim Tombali.

Below: a heavy bone wrapped in plaster of Paris is carried to camp.

TENDAGURU EXPEDITIONS

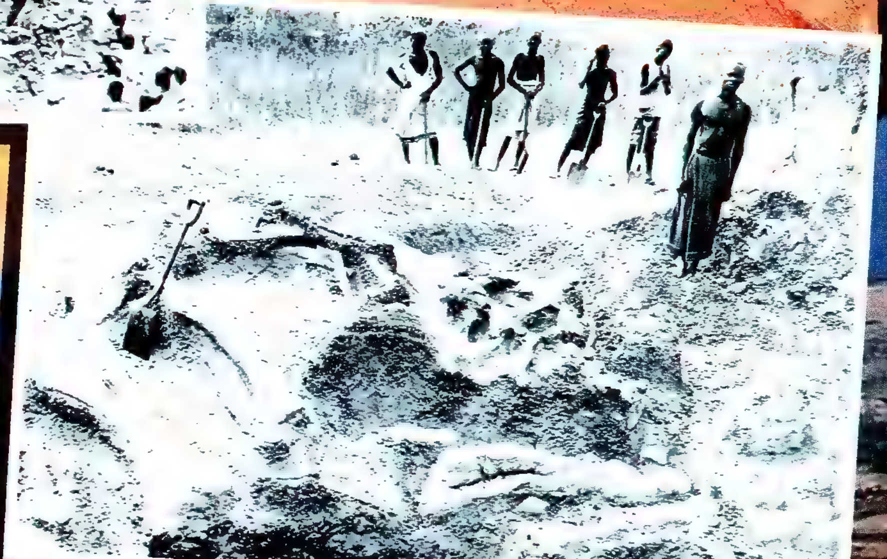
- Led by Werner Janensch
- To Tendaguru, Tanzania
- 1909-1912
- From Germany
- Major finds – *Brachiosaurus, Dryosaurus, Dicraeosaurus, Kentrosaurus*





At Tendaguru, the trees were cleared and deep pits like the one above were dug by hand through the tree roots.

Huge numbers of large dinosaur bones were exposed by local workers digging with spades (below).



SAHARA DESERT EXPEDITIONS

- **Led by Philippe Taquet**
- **To Niger, west Africa 1965-1974**
- **From France**
- **Major find – *Ouranosaurus***

The 1974 expedition members drove Land Rovers (above), and kept in touch with colleagues by radio.

LESOTHO EXPEDITIONS

- **Led by Alan Charig, John Attridge**
- **To Lesotho, South Africa**
- **1966-67**
- **From Britain**
- **Major finds – *Massospondylus, Lesothosaurus***

An expedition member (right) prepares dinner at camp in Lesotho.

FROM FRANCE

In the Sahara Desert many fossil bones lie exposed where the wind has blown away the sand. A series of expeditions from France's Museum of Natural History led by Philippe Taquet found several complete dinosaur skeletons. One of these was a new dinosaur named *Ouranosaurus*. This was one of the strangest dinosaurs ever found, with a bony sail along its back.

FROM UK

South Africa has proved to be a rich source of dinosaur bones. These expeditions in the 1960s from the British Museum and London University explored the mountains and valleys of Lesotho. Here the cliffs were being worn away so quickly that experts would excavate part of a dinosaur on one day, and find the remains of another just behind it the next day. The small, two-legged, plant-eating dinosaur *Lesothosaurus* was named after the country in which it was found.

A dinosaur bone (above) in front of the complete skeleton of a crocodile.

Philippe Taquet (left) also hunted dinosaurs in Madagascar, an island off east Africa, in 1974.

The expedition to Orange Free State (above). David Norman is in the centre of the front row.

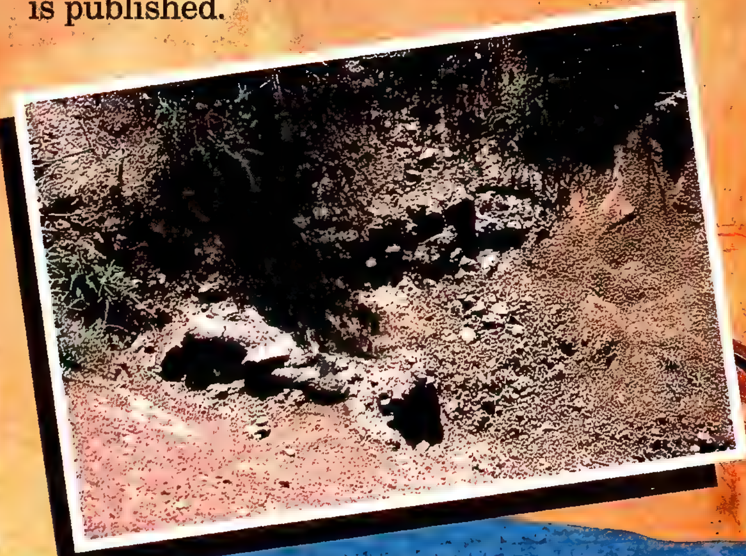
— ORANGE FREE STATE EXPEDITION —

- **Led by Roger Smith**
- **To Orange Free State**
- **1993**
- **From South Africa, UK and USA**

FROM SOUTH AFRICA, UK AND USA

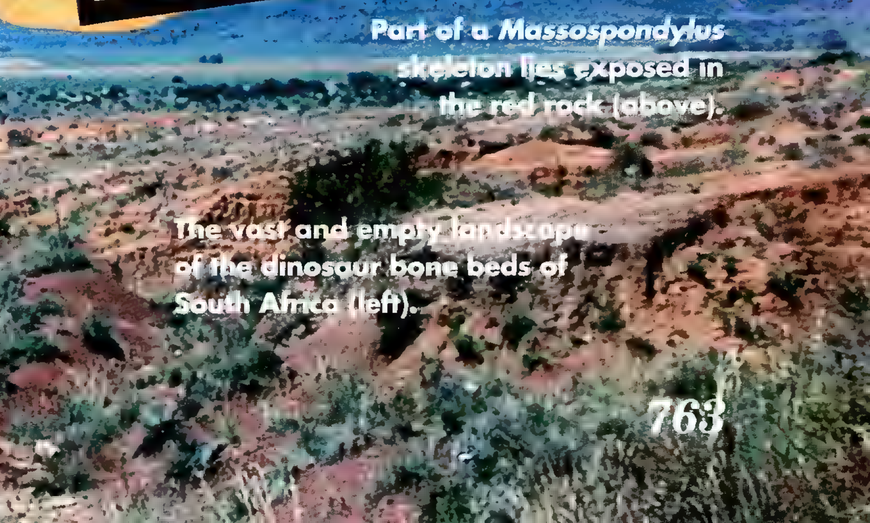
New bones and other fossils are constantly being excavated. In 1993 David Norman took part in an expedition to Orange Free State in South Africa where more new finds were made. The expedition explored rocks from the Late Triassic which contain early fossils of *Massospondylus* and *Euskelosaurus*. They found the remains of many dinosaurs, including some new early ornithiscians (bird-hipped dinosaurs), as well as some mammal-like reptiles and an early crocodile skeleton. These fossils are prepared in the laboratory before scientific information about them is published.

The Lesotho expedition had help from local fieldworkers (left), just as the German expedition did earlier this century.



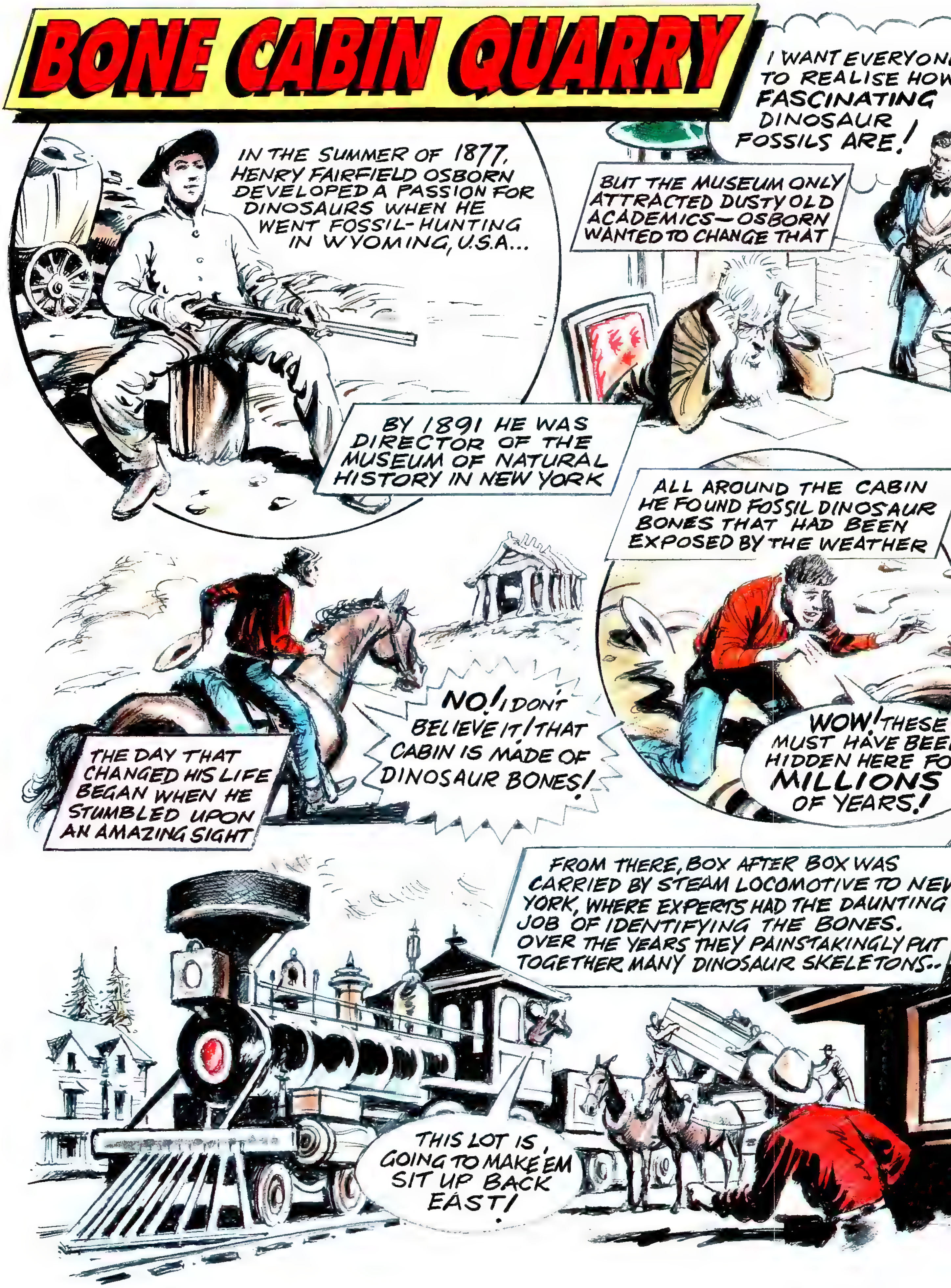
Part of a *Massospondylus* skeleton lies exposed in the red rock (above).

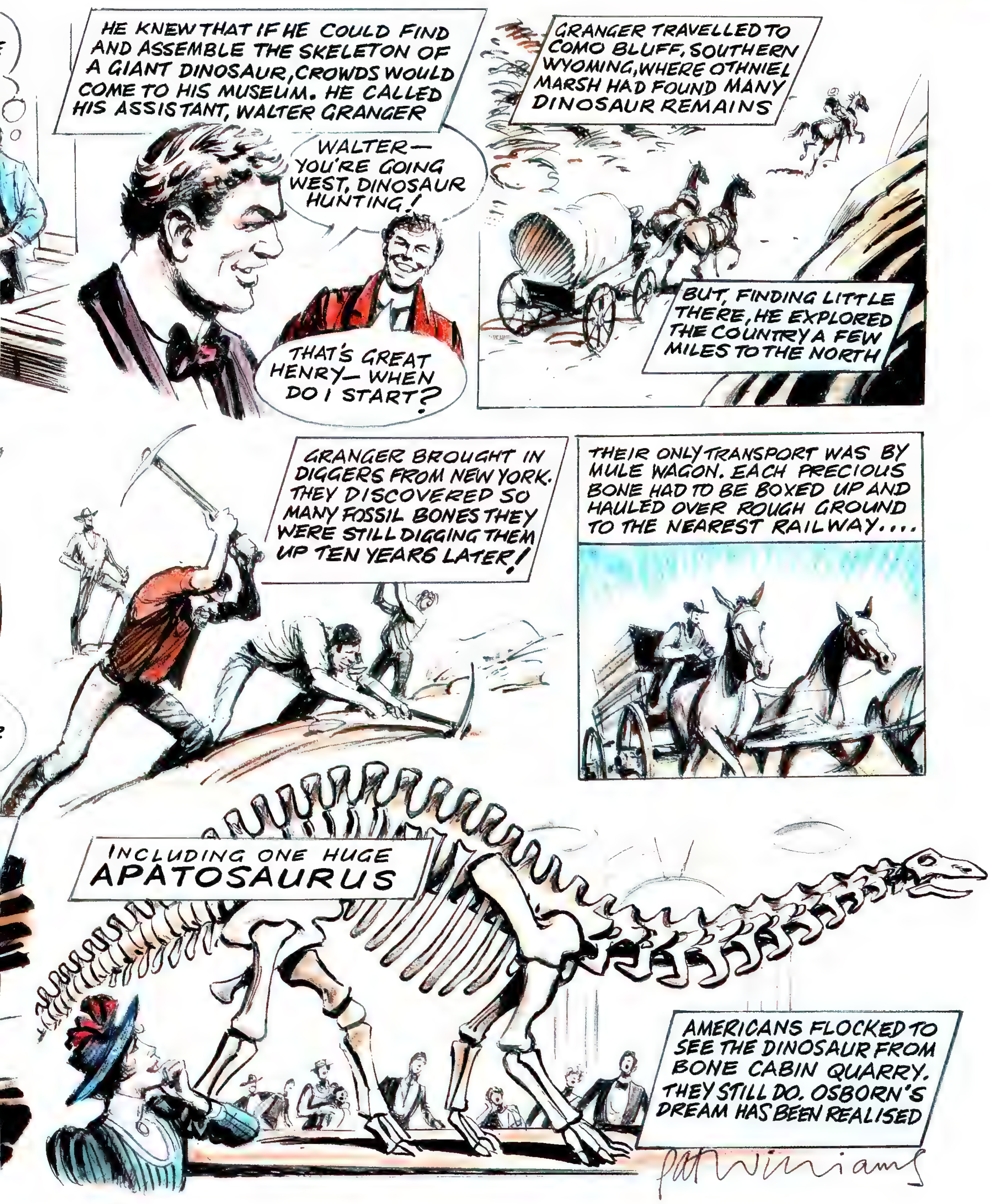
Fieldworker Ione Rudner (above) works in the hot sun on a bare, rocky mountainside in Lesotho.



The vast and empty landscape of the dinosaur bone beds of South Africa (left).

BONE CABIN QUARRY


IN THE SUMMER OF 1877, HENRY FAIRFIELD OSBORN DEVELOPED A PASSION FOR DINOSAURS WHEN HE WENT FOSSIL-HUNTING IN WYOMING, U.S.A...
BY 1891 HE WAS DIRECTOR OF THE MUSEUM OF NATURAL HISTORY IN NEW YORK
I WANT EVERYON TO REALISE HOW FASCINATING DINOSAUR FOSSILS ARE!
BUT THE MUSEUM ONLY ATTRACTED DUSTY OLD ACADEMICS—OSBORN WANTED TO CHANGE THAT
THE DAY THAT CHANGED HIS LIFE BEGAN WHEN HE STUMBLED UPON AN AMAZING SIGHT
NO! I DON'T BELIEVE IT! THAT CABIN IS MADE OF DINOSAUR BONES!
ALL AROUND THE CABIN HE FOUND FOSSIL DINOSAUR BONES THAT HAD BEEN EXPOSED BY THE WEATHER
WOW! THESE MUST HAVE BEE HIDDEN HERE FO MILLIONS OF YEARS!
FROM THERE, BOX AFTER BOX WAS CARRIED BY STEAM LOCOMOTIVE TO NE YORK, WHERE EXPERTS HAD THE DAUNTING JOB OF IDENTIFYING THE BONES. OVER THE YEARS THEY PAINSTAKINGLY PUT TOGETHER MANY DINOSAUR SKELETONS..
THIS LOT IS GOING TO MAKE 'EM SIT UP BACK EAST!


HE KNEW THAT IF HE COULD FIND AND ASSEMBLE THE SKELETON OF A GIANT DINOSAUR, CROWDS WOULD COME TO HIS MUSEUM. HE CALLED HIS ASSISTANT, WALTER GRANGER
WALTER— YOU'RE GOING WEST, DINOSAUR HUNTING!
THAT'S GREAT HENRY— WHEN DO I START?
GRANGER TRAVELLED TO COMO BLUFF, SOUTHERN WYOMING, WHERE OTHNIEL MARSH HAD FOUND MANY DINOSAUR REMAINS
BUT, FINDING LITTLE THERE, HE EXPLORED THE COUNTRY A FEW MILES TO THE NORTH
GRANGER BROUGHT IN DIGGERS FROM NEW YORK. THEY DISCOVERED SO MANY FOSSIL BONES THEY WERE STILL DIGGING THEM UP TEN YEARS LATER!
THEIR ONLY TRANSPORT WAS BY MULE WAGON. EACH PRECIOUS BONE HAD TO BE BOXED UP AND HAULED OVER ROUGH GROUND TO THE NEAREST RAILWAY....
INCLUDING ONE HUGE APATOSAURUS
AMERICANS FLOCKED TO SEE THE DINOSAUR FROM BONE CABIN QUARRY. THEY STILL DO. OSBORN'S DREAM HAS BEEN REALISED
Pat Williams

Improve and test your knowledge with...

DINO Fact File

Triceratops holds all the answers. See how you score in the quiz.

1 Which complete dinosaur did Werner Janensch find in eastern Africa?

a) *Apatosaurus*
b) *Triceratops*
c) *Brachiosaurus*

2 *Chilantaisaurus* was a:

a) large agile meat-eater
b) large heavy plant-eater
c) duckbilled plant-eater

3 What part of *Pinacosaurus'* body was not covered with armour?

a) its tail
b) its head
c) its belly

4 What did *Lesothosaurus* eat?

a) pterosaurs
b) plants
c) fish

5 What did Henry Osborn find?

a) a cabin made out of dinosaur bones
b) bones belonging to a giant human
c) a complete *T rex* skeleton

Death by choking

Experts have found rocks as big as grapefruits lodged in a dinosaur's oesophagus – the tube that carries food to the stomach. Dinosaurs swallowed these rocks to grind up tough plants in their stomachs. But the rocks were sometimes too big for the dinosaur to swallow and it died choking.

Gobi fossils

The best preserved dinosaur fossils in the world are buried in the Gobi Desert in Mongolia. While the continents drifted around the Earth, breaking up and reforming, the Gobi remained undisturbed within the huge continent of Asia. The Gobi Desert has been covered by sand for 100 million years and the fossils found there are usually intact.

Dragons or dinosaurs?

The Chinese name 'kong long' has a double meaning. It means both 'dinosaur' and 'terrible dragon'!

6 Which of these dinosaurs had the strongest arms?

a) *Carnotaurus*
b) *Ouranosaurus*
c) *Deinonychus*

7 *Brachiosaurus* was as heavy as:

a) 15 elephants
b) four cows
c) a bus

8 What was *Pinacosaurus'* deadly weapon?

a) its heavy tail-club
b) its razor-sharp teeth
c) its knife-like claws

9 Which tools were used to dig up bones on the Tendaguru expeditions?

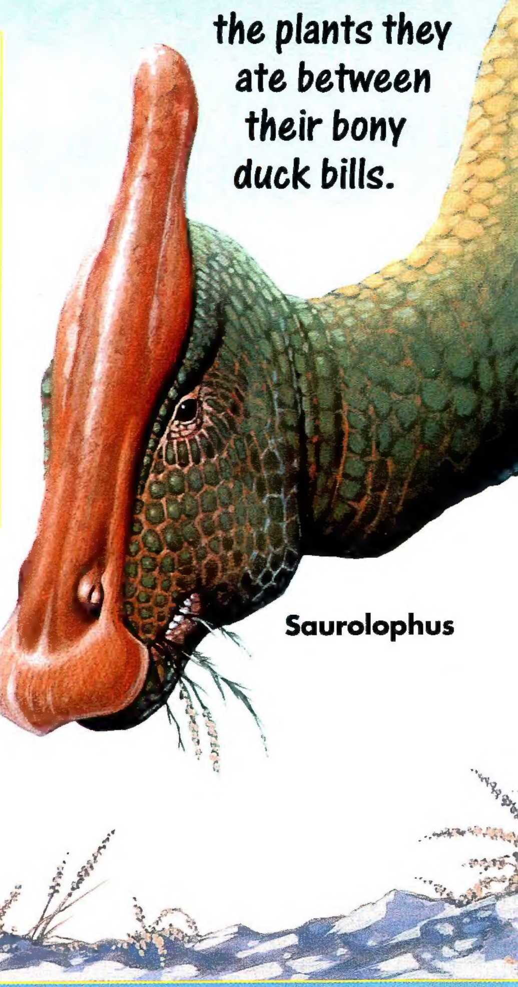
a) bulldozers
b) spades
c) road drills

10 How are dinosaur skeletons cleaned?

a) with soap and water
b) in an acid bath
c) with brushes

Food crushers

Although duckbilled dinosaurs had bills the same shape as ducks, they didn't use them in the same way. Ducks swallow all their food whole, whereas duckbilled dinosaurs crushed the plants they ate between their bony duck bills.



Saurolophus

Storage space

Big dinosaur bones need big storage spaces. Under a football stadium in Provo, Utah, USA, hundreds of fossils are still wrapped in their plaster casts waiting to be examined by experts.

Earth-shaking bones

Scientists have been excavating a Seismosaurus skeleton found in New Mexico for the past eight years. One of the pelvic bones, called the sacrum, measures 1½m long and weighs 1450kg – the weight of about 20 average-sized adult humans. It took six months to remove this one bone from the surrounding concrete-like rock.

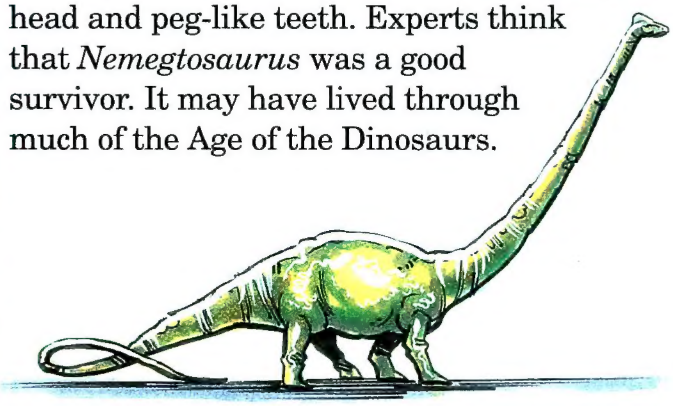
Answers to the questions on inside back cover

NANOTYRANNUS 75 MYA

Nanotyrannus (nan-oh-ty-ran-nus) was a fast, dangerous dinosaur. It was a tyrannosaurid, about one third of the size of *T rex*. *Nanotyrannus* lived in Montana, USA during the Late Cretaceous Period. More agile than its heavier relatives, it pursued prey such as young duckbilled dinosaurs. *Nanotyrannus* was about 5m long and weighed 500kg. Its name means 'tiny tyrant'.

NEMEGTOSAURUS 70 MYA

Nemegtosaurus (nem-egt-oh-saw-rus) means 'Nemegt reptile' after a valley in the Gobi Desert, Mongolia, where its skull was found. A plant-eater from the Late Cretaceous Period, *Nemegtosaurus* had a long, sloping head and peg-like teeth. Experts think that *Nemegtosaurus* was a good survivor. It may have lived through much of the Age of the Dinosaurs.



NOASAURUS 70 MYA

Noasaurus was a meat-eater the size of a small car. The most striking feature of this small, hunting dinosaur was the sharp, hooked claw on its foot. This was attached to a strong muscle which gave it great power and flexibility. *Noasaurus* (no-a-saw-rus) means 'reptile from Noa', the place in north-west Argentina where its fossil was found.

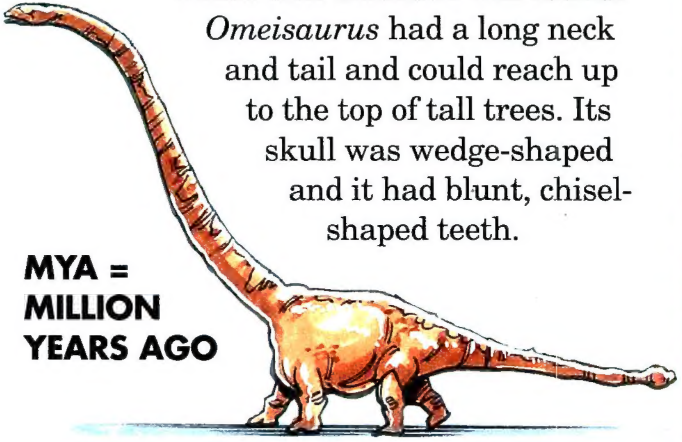
NODOSAURUS 95 MYA

Nodosaurus (node-oh-saw-rus) was an armoured dinosaur from Kansas and Wyoming, USA. Its name means 'nodular (lumpy) reptile'. *Nodosaurus* was covered with bony knobs which were arranged in bands along its body. Longer than two small cars, *Nodosaurus* had four powerful legs to support its weight. Its skull has not been found, but it was probably low and narrow like that of *Panoplosaurus*.

O

OMEISAURUS 150 MYA

As long as two double-decker buses, the huge sauropod *Omeisaurus* (om-i-saw-rus), lived in the Late Jurassic Period in China. It takes its name from Mount Omei near the place where this dinosaur was found. *Omeisaurus* had a long neck and tail and could reach up to the top of tall trees. Its skull was wedge-shaped and it had blunt, chisel-shaped teeth.

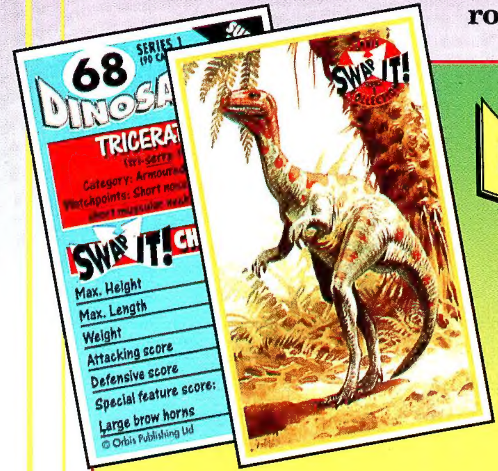


MYA = MILLION YEARS AGO

COMING IN PART 33 OF

DINOSAURS!

Find out about a century of dinosaur hunting in North America in TIME DETECTIVE. Discover which dinosaurs roamed Europe in DINOWORLD.



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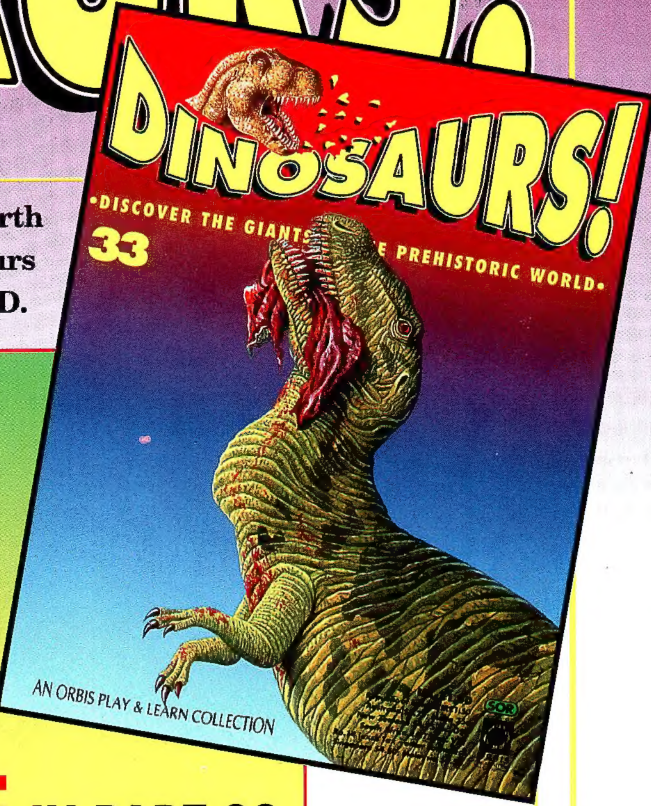
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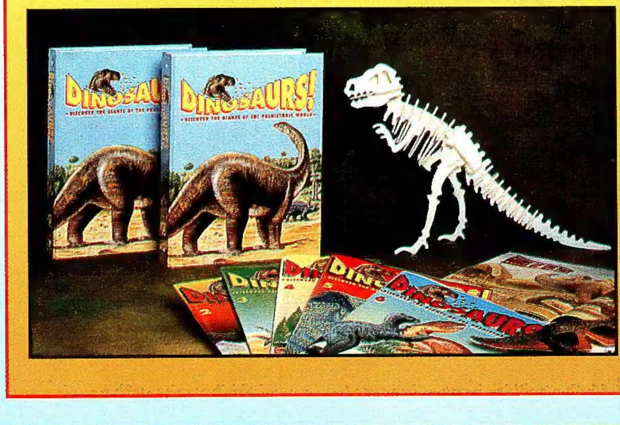

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ANSWERS TO DINO FACT FILE QUESTIONS: 1.c 2.a 3.c 4.b 5.a 6.c 7.a 8.a 9.b 10.c

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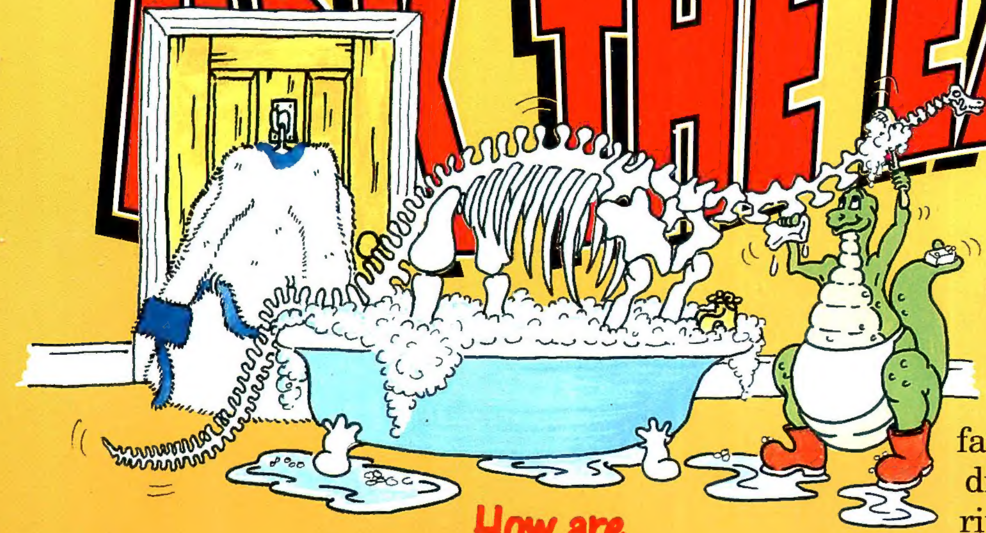
ASK THE EXPERT

Dr. David Norman of Cambridge University answers your dinosaur questions



How are dinosaur skeletons cleaned when they get dusty or dirty?

This is a real problem for museums because skeletons get covered in dust. A major clean-up happens rarely because it means that a gallery might have to be closed. Museum laboratory assistants clean skeletons with brushes and fine vacuum-cleaner nozzles. They also have to be able to carry out small repairs to bones.

What would a plant-eating dinosaur eat if it were alive today?

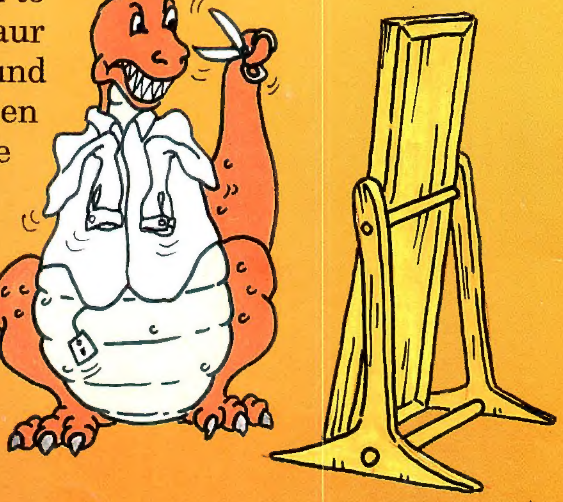
Dinosaurs today might eat plants that are similar to those that were alive during the time of the dinosaurs. For example, pine trees, cypress trees, magnolias and ferns. But they would have been puzzled by grass, as it didn't exist in dinosaur times!

Who are the most famous palaeontologists?

Professor Richard Owen is famous for inventing the name dinosaur in 1842. The American rivals Professors Marsh and Cope are famous for discovering more than 100 new dinosaurs between 1877 and 1895. Today, Jack Horner, who discovered *Maiasaura*'s and *Orodromeus*' nests, is one of the best known palaeontologists.

Why did T rex have such short arms?

T rex' short arms have puzzled experts for years. Some think they were used to help the dinosaur get off the ground when it had been resting. A more likely answer is that the arms held prey very close to the dinosaur's body. This made it easier to eat. Though short, *T rex*' arms were very strong, and had sharp claws to help it grip its prey.



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